REMARKS

Reconsideration and allowance of this application, as amended, is respectfully requested.

This amendment is in response to the Office Action dated January 10, 2003. It is noted that this Office Action adds a new primary reference to Hartner (WO 9815013 A1) to the rejection of the claims in place of the previous rejection set forth in the January 11, 2002 Office Action based on the combination of Fazan (USP 5,478,772) in view of Okudaira (USP 5,418,388).

Reconsideration and removal of the rejection of claims 1-4, 7-11 and 14-18 and 29 over the combination of Hartner and Okudaira is respectfully requested. With regard to this, it is noted that independent claims 1 and 7 have been amended and new claims 30 to 33 have been added to further clarify the distinctions of the invention over this combination of references. Independent claim 14 remains unamended inasmuch as it defines different aspects of the invention, as will be discussed separately below.

Turning first to independent claims 1 and 7, these claims set forth a structure which can be appreciated from studying Fig. 1 of the present application (noting that the reference to Fig. 1 is solely for purposes of example, and not intended to limit the claims only to this specific details of this embodiment). In the example of Fig. 1, a capacitor is provided which includes a lower electrode 61, a ferroelectric film 71 and an upper electrode 72. This capacitor is formed over an interlayer insulating film 28 and also over a conductive plug 42. In accordance with the present invention as claimed in independent claims 1 and 7, there are two fundamental problems are solved by the structure of the invention defined in claims 1 and 7:

1. A reaction between the interlayer insulator 28 and the ferroelectric film 71 of the capacitor is prevented by the use of a reaction barrier film 43 (which can be formed by mat rial such as TiO_2); and

2. Preventing oxidation b tween the lower electrode 61 and the conductive plug 42 by the use of a diffusion barrier layer 51 (which can be comprised, for example, of TIN).

Both independent claims 1 and 7 define the use of the reaction barrier film between the insulating film and the ferroelectric film and the diffusion barrier film between th conductive film and the first electrode (e.g. the bottom electrode of the capacitor).

In order to further emphasize the composition and advantageous operation of the reaction barrier film, each of claims 1 and 7 has been amended to define:

> "wherein a reaction barrier film is provided between the insulating film and the ferroelectric film to prevent a reaction between the insulating film and the ferroelectric film."

It is respectfully submitted that this serves to even further emphasize the distinctions over the combination of Hartner and Okudaira for the reason set forth below.

In the Office Action, it is recognized that Hartner does not teach the use of the insulating layer 4 as being TiO_2. (e.g. see page 3, lines 3 and 4 of the Office Action). In fact, Hartner teaches that the insulating film 4 is comprised of SiN. What is important to recognize, however, is that SiN film does not function well for preventing a reaction between an insulating film and a ferroelectric film. Instead, the SiN layer 4 in Hartner serves as a good oxygen diffusion barrier between the ferroelectric 6 and the interlayer insulating film 2 in Hartner. This can be appreciated from column 5, line 53 et. seq. of the US counterpart (USP 6,043,529) of the Hartner document in the statement:

> "at the same time, the silicon nitride layer 4 reliably protects the embedded layer 3 against oxidation and ensures the integrity of the platinum/barrier layer/plug structure. As is know, silicon nitride is a good oxygen diffusion barrier, which, in the present case, prevents oxygen from being fed to the junction region between the barrier layer 3 and the lower electrode 5 from the surroundings."

Thus, it is clear that Hartner uses the SiN layer as an oxygen diffusion barrier, but teaches absolutely nothing with regard to the use of this film for preventing an undesirable reaction between the ferroelectric film and the interlayer insulating film. The reason this is not taught is because SiN does not have such a function of preventing a reaction. As such, the primary reference to Hartner completely lacks the important claimed feature of the reaction barrier film defined in claims 1 and 7 of the present application "to prevent a reaction between the insulating film and the ferroelectric film."

In the Office Action, reference is made to Okudaira for suggesting the substitution of a TiO_2 film in Hartner in place of the SiN layer 4 of Hartner. In response to this, Applicants note that the layer 11 of Okudaira is disclosed as being an adhesion layer for improving adhesion between the ferroelectric film 15 and the interlayer insulator 10 (e.g. see column 6, lines 16-24 of Okudaira). However, nothing in Okudaira teaches or suggests that an SiN layer such as used in Hartner could be replaced by a TiO_2 layer in order to operate as a reaction barrier layer to prevent a reaction between an interlayer insulator and a ferroelectric film. It is well recognized that, in order to modify a reference, motivation must exist within the cited references themselves for making the proposed modification. This has been taught in a variety of decisions, including *In re* Lee, 61 USPQ2d 1430, Ex parte Gerlach, 212 USPQ 471 and *In re* Antonie, 195 USPQ 6. In the present instance, it is respectfully submitted that neither of the references to Hartner nor Okudaira give th necessary motivation for making the suggested change. Hartner completely lacks any teaching of suggesting a reaction barrier, and explicitly provides a material which is not a good reaction barrier. Okudaira teaches the use of a layer 11 to improve adhesion, and, again, does not suggest the use of his material for modifying other structures to provide a reaction barrier between a ferroelectric film and an interlayer insulating film. Therefore, it is resp ctfully submitted that there is no suggestion in either of the cited references for

making th propos d modification, and that the only suggestion for this comes from Applicants' own disclosure. The use of Applicants' own disclosure in formulating a hindsight rejection is, of course, not permitted, as recognized by the above-noted cas law.

For the reasons set forth above, reconsideration and removal of the rejection of independent claims 1 and 7 and their respective dependent claims over the combination of references to Hartner and Okudaira is respectfully requested. As noted, these claims particularly define the use of a reaction barrier layer to prevent a reaction between a ferroelectric film and an interlayer insulating film, and such structure and operation is neither taught nor suggested by the cited references.

Consideration and allowance of the newly submitted claims 30-33 on this point is also respectfully requested. New independent claims 30 and 32 correspond, respectively, to claims 1 and 7, except for defining the invention as including "means for preventing a reaction between the insulating film and the ferroelectric film." As such, these claims specifically define the functional feature of the present invention in preventing a reaction between these two films. Neither Hartner nor Okudaira teach or suggest any such means for preventing this reaction. In the case of Hartner, the insulating film 4 clearly will not serve this purpose. In Okudaira, the adhesion layer 11 is particularly utilized for improving adhesion, and is not provided for preventing a reaction between a ferroelectric film and an insulating film as required by claims 30-33. Therefore, consideration and allowance of these claims 30 and 32, together with their respective dependent claims 31 and 33 is respectfully requested.

Reconsideration and allowance of independent claim 14 over the combination of Hartner and Okudaira is also respectfully requested. Claim 14 defines an arrangement such as shown in the embodiment of Figs. 19-21 (again noting that referenc to a specific

embodiment is solely for purposes of example). In particular, claim 14 defines an arrangement in which a plug itself is formed of a diffusion barrier layer provided to extend completely through an opening in an insulating film. Claim 14 further defines a reaction barrier film is provided in self alignment with the first electrode in conjunction with this structure utilizing the diffusion barrier layer as a plug extending completely through an opening in an insulating film. It is respectfully submitted that nothing in either Okudaira nor Hartner teaches or suggests the use of a plug itself as a diffusion barrier, particularly in combination with a reaction barrier formed in self alignment with a first electrode. Hartner teaches an arrangement in which a diffusion barrier 3 is located on top of a conductive plug 1, and Okudaira teaches a similar arrangement in which a diffusion barrier 13 is formed on top of a conductive plug 12. Neither Hartner nor Okudaira teach or suggest the claim structure for a diffusion barrier itself serving as a plug extending completely through an interlayer insulating film. Therefore, it is respectfully submitted that claim 14 defines a structure which clearly distinguishes over the cited prior art, and reconsideration and allowance of claim 14 on this basis is respectfully requested, together with its dependent claims.

If the Examiner believes that there are any other points which may be clarified or otherwise disposed of either by telephone discussion or by personal interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The changes are shown on the attached pages, the first page of which is captioned "Version With Markings To Show Changes Made."

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in f es due in connection with the filing of this paper,

including extension of time fees, to the Deposit Account No. 01-2135 (Case No. 520.37546X00), and please credit any excess fees to such Deposit Account.

Respectfully submitted,

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Attachment: Version With Markings To Show Changes Made

ATTACHMENT

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please amend claims 1 and 7 as follows:

1. (Twice Amended) A semiconductor device comprising:

an insulating film formed on a substrate provided with a transistor and having an opening portion;

a conductive film formed in the opening portion; and

a capacitor formed on the conductive film and comprising a first electrode, a ferroelectric film and a second electrode;

wherein the ferroelectric film includes at least one element selected from the group consisting of lead, barium and bismuth and formed from above the first electrode to above the insulating film;

wherein a reaction barrier film is provided between the insulating film and the ferroelectric film to prevent a reaction between the insulating film and the ferroelectric film, said reaction barrier film being in contact with a lower surface of said first electrode such that the reaction barrier film is interposed between the lower surface of the first electrod and said insulating film;

wherein a diffusion barrier film is provided between the conductive film and the first electrode and side faces of the diffusion barrier are not brought into contact with the ferroelectric film;

wherein an upper surface of said diffusion barrier film and an upper surface of said reaction barrier film are substantially on a same plane; and

wh rein side fac s of the first electrode are provided t be brought into contact with the ferroelectric film.

7. (Amended) A semiconductor device comprising:

a substrate provided with a transistor;

an insulating film formed on the substrate and having an opening portion;

a conductive film formed in the opening portion; and

a capacitor formed on the conductive film and comprising a first electrode; a ferroelectrics film and a second electrode;

wherein the ferroelectric film includes at least one element selected from the group consisting of lead, barium and bismuth and formed on an upper face and side faces of the first electrode and on the insulating film;

wherein a reaction barrier film is provided between the insulating film and the ferroelectric film to prevent a reaction between the insulating film and the ferroelectric film, said reaction barrier film being in contact with a lower surface of said first electrode such that the reaction barrier film is interposed between the lower surface of the first electrode and said insulating film;

wherein a diffusion barrier film is provided between the conductive film and the first electrode and in the opening portion of the reaction barrier film; and

wherein an upper surface of said diffusion barrier film and an upper surface of said reaction barrier film are substantially on a same plane.